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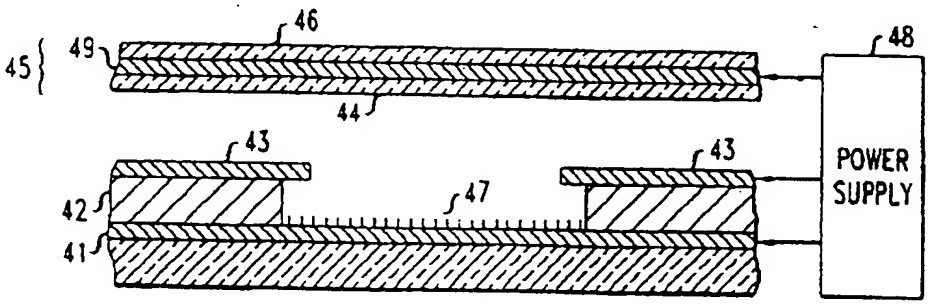
(54) Device comprising a carbon nanotube field emitter structure and process for forming device

(57) The invention provides improved devices containing adherent carbon nanotube films, in particular electron field emitter structures containing such films. Previously, attaining even moderate adherence of powdery or mat-like nanotubes to a substrate was difficult, because of the perfect fullerene structure of nanotubes, which tend to exhibit no dangling bonds or defect sites where chemical bonding to the substrate is able to occur. The invention overcomes these problems, and provides a strongly adherent nanotube film, by a variety of fabrication processes including dispersion of carbon nanotubes in a solvent and spraying the dispersion at a substrate.

FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 99 30 7243

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	HUBLER U ET AL: "Scanning probe microscopy of carbon nanotubes" CARBON,US,ELSEVIER SCIENCE PUBLISHING, NEW YORK, NY, vol. 36, no. 5-6, 1998, pages 697-700, XP004124256 ISSN: 0008-6223 * page 699 *	1,2	H01J1/30 H01J9/02
X	MASAKO YUDASAKA ET AL: "SPECIFIC CONDITIONS FOR NI CATALYZED CARBON NANOTUBE GROWTH BY CHEMICAL VAPOR DEPOSITION" APPLIED PHYSICS LETTERS,US,AMERICAN INSTITUTE OF PHYSICS. NEW YORK, vol. 67, no. 17, 20 October 1995 (1995-10-20), pages 2477-2479, XP000544337 ISSN: 0003-6951 * page 2477 *	1,2	
X	EP 0 838 831 A (MOTOROLA INC) 29 April 1998 (1998-04-29) * column 7, line 31 - line 39 * * column 7, line 55 * * column 12, line 22 - column 14, line 32; figures 7,8 *	1,2,5	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H01J C01B
D,X	WANG Q; SETLUR A ET AL.: "A nanotube-based field-emission flat panel display" APPLIED PHYSICS LETTERS, vol. 72, no. 22, 1 June 1998 (1998-06-01), pages 2912-2913, XP002151739 * the whole document *	1,2	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 January 2001	Colvin, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 99 30 7243

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 7243

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 98 11588 A (UNIV CALIFORNIA) 19 March 1998 (1998-03-19) * page 7, line 27 - line 34 * * page 9, line 31 - page 10, line 7 * * page 11, line 25 - line 36 * * page 19, line 25 - line 34 * * example 4 *	1,2,5	
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A	WANG Q H ET AL: "FIELD EMISSION FROM NANOTUBE BUNDLE EMITTERS AT LOW FIELDS" APPLIED PHYSICS LETTERS,US,AMERICAN INSTITUTE OF PHYSICS. NEW YORK, vol. 70, no. 24, 15 June 1997 (1997-06-15), pages 3308-3310, XP000885052 ISSN: 0003-6951 * page 3308 *	19	
A	WO 97 45854 A (MINNESOTA MINING & MFG) 4 December 1997 (1997-12-04) * page 3, line 7 - line 9 * * page 11, line 13 - line 14 * * page 13, line 10 - line 18 *	4	TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 January 2001	Colvin, G

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D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 99 30 7243

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-3, 5-16

   Process for fabricating a device comprising steps of disposing carbon nanotubes on a substrate and heating

2. Claims: 4,17,18

   Process for fabricating a device comprising steps of forming a carbon nanotube dispersion and spraying on a substrate

3. Claim : 19

   Process for fabricating a device comprising steps of disposing carbon nanotubes on a substrate whilst applying an electric/magnetic field

4. Claims: 20,21

   Process for fabricating a device comprising steps of mixing carbon nanotubes with a polymer and disposing the composite material on a substrate

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 30 7243

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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05-01-2001

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